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NHL Steam Schooner Wapama
Condition Survey and Preservation Recommendations

Richmond, CA
October 2006

Pase 1B Draft Options Report

ARCHITECTURAL RESOURCES GROUP
Architects, Planners & Conservators, Inc.

NHL S.S. STEAM SCHOONER *WAPAMA*
CONDITION SURVEY

Phase 1B Draft Options Report

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NHL S.S. STEAM SCHOONER *WAPAMA*
CONDITION SURVEY

Phase 1B Draft Options Report

Background

Architectural Resources Group (ARG) has been retained by the National Park Service (NPS) to provide a two-phase Condition Survey of the National Historic Landmark Steam Schooner *Wapama.* This vessel, built in 1915, is the last survivor of over 200 built and is currently resting on a barge at the Richmond Reserve Shipyard in Richmond, CA. *Wapama* was transferred from the water to the barge about 25 years ago because of her deteriorated condition and fears that she might sink at the San Francisco Maritime Historic Park pier. Since then she has received sporadic maintenance, and the ravages of time and exposure to weather and fresh water have taken a heavy toll.

To assist in the evaluation, ARG, as Team Leader, has retained the services of BMT Designers & Planners (D&P) of Arlington, VA for naval architecture evaluation with assistance from Allen C. Rawl Inc. (ACR), experts in wooden ship preservation and construction, and Winzler & Kelly, Consulting Engineers (W&K) of San Leandro, CA for evaluation of the presence of and nature of hazardous materials. Several meetings and on-board surveys have been conducted beginning in mid June 2005 with the goal of providing updated information as to the safety and stability of the vessel and the barge, updated structural analysis of the vessel, and recommendations for near and longer term actions to stabilize and possibly dismantle parts of the vessel. This report reviews the first phase of the work and generally covers the condition of the vessel and identifies a range of action options for consideration by the NPS. The results of this Report will provide the basis for the second phase of the work which will be to identify and evaluate preservation options and select one of the suggested options, or variation thereof, to study in further detail. In addition, at NPS request, we have contracted with the University of Minnesota through the USDA Forest Products Laboratory to perform a physical condition assessment of the main structural members to aid BMT D&P in their analysis in Phase 1B. Based on that report, the information herein may be supplemented and/or revised.

Significance of Vessel

The significance of the *Wapama* is that she is the last survivor of her breed and she represents an important link in the transition from the wooden sailing schooners of the 19th Century to the steel cargo ships that would be developed shortly after in the late teens and twenties. She and others like her plied the waters of the Pacific Coast for many years furnishing the lumber from Northern California and the Northwest to develop the cities and towns to the south.

NHL S.S. STEAM SCHOONER *WAPAMA*
CONDITION SURVEY

Phase 1B Draft Options Report

Condition of Vessel

Wapama was in a deteriorated condition when she was removed from the water. After 25 years out of the water she is in much worse condition, such that there is little if any of her original hull materials that can be saved. The rot and loss of structural integrity are too great. The rebuilding of the *C. A. Thayer* in a former aircraft hangar in Alameda is testimony to the level of work required on a wooden vessel that had been maintained on a regular basis and kept floating until rehabilitation started. Approximately 90 % of the *C.A. Thayer* hull material is being replaced. The after cabin superstructure on the other hand, is in much better shape due to more concerted efforts to protect and maintain those areas of the ship that were least deteriorated to begin with and easiest to protect. *Wapama* is in a precarious structural state and requires some immediate steps to alleviate safety and liability risks as outlined in the Condition Survey. In addition we recommend an aggressive schedule for determining disposition and for funding other required short-term stabilization measures. We must emphasize that this vessel presents a large "sail area" to the wind, and is in potential danger of movement within its lateral supports, which could result in a threat to life safety as well as possible collapse resulting in material coated with lead paint falling into the water.

Executive Summary of Options and Recommendations

Based on the report contained in Appendix A and as agreed with NPS and SAFR at a meeting on March 28, 2006 at the National Maritime Historic Park at Fort Mason, the consultant team has reviewed the major options for the preservation, display and interpretation of the Wapama along with rough-order-of-magnitude costs. These options include:

1. **Full Rehabilitation and Restoration of the Vessel** to a floating but not mechanically running condition as a display at the Hyde Street Pier. This option would be very expensive as based on the costs derived from work on the C.A.Thayer but would result in the best interpretation of the genre.

2. **Full Stabilization of the Vessel** that would include moving it to a government-owned covered facility and to treat it to halt the deterioration but understanding that the deterioration is so far advanced that much of the hull is deteriorated beyond salvage. This option would either represent final disposition or buy some time for future restoration and rehabilitation as

indicated in Option 1. This option would put the vessel in a holding situation and ideally inside the building in which future restoration and rehabilitation might take place. It would not at this point be considered an exhibit as it would be surrounded by shoring. It would represent a fairly expensive holding action probably with some continued deterioration and liability. Environ mental controls might be needed for the stabilization to be effective.

3. **Partial Salvage, Restoration & Display of a Major Portion of the Vessel and Major Components of the Deck Gear at a Land Based Facility**. This option anticipates the removal of the deteriorated forward end of the ship and the remainder transported to a land based facility for rehabilitation and eventual display. The continued deterioration and liability would be obviated.

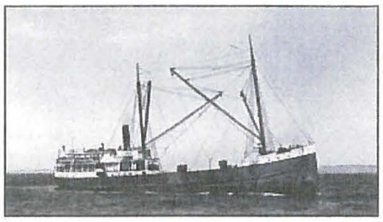
4. **Dismantling and Selective Salvage, Restoration & Display of Elements of the Vessel and Major Components of the Deck Gear at a Land Based facility**. This option assumes the complete dismantling of the vessel and the salvage of major members and equipment for display in a new museum building.

The only other more extreme but obvious option not addressed is to dismantle and dispose of the entire vessel and the history that it represents – an expensive proposition in itself but one that obviates the current liability concerns while at the same time completely destroying a historic resource.

In conclusion, Options 1 and 2 both seem to represent costly and risky ventures given the deteriorated state of the vessel. Options 3 and 4 seem to represent a more realistic approach physically and financially, again given the deteriorated state.

We look forward to using this draft report in preparation for the future Value Analysis that will determine the recommended disposition of WAPAMA.

SS WAPAMA
DISCUSSION OF OPTIONS FOR DISPLAY AND PRESERVATION



D&P Report No. 2526-001
October 31, 2006

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1. D&P Report No. 2526-001, "Wapama Condition Survey", October 7, 2005

2. Natural Resources Research Institute (NRRI) at University of Minnesota Duluth and USDA Forest Products Laboratory report, "Condition Assessment of Main Structural Members of WAPAMA", 2006

SS Wapama Options for Display and Preservation

Background

The vessel *Wapama* (Figure 1) is the last remaining example of the wooden steam-powered schooner, which hauled lumber and passengers on the Pacific Coast. She was built in 1915 and is registered as a National Historic Landmark (NHL). She is constructed of old growth Douglas Fir, and is 216 feet long and approximately 50 feet from keel to house top, with a gross tonnage of 945 GT. In 1979, she was removed from her berth at the California State Historical Maritime Park at Hyde Street Pier and moved to a submarine pen at Hunter Point Naval Shipyard. This move to quiet water was to minimize stress on her hull. Prior to building a breakwater in the mid 1980's, the Hyde Street Pier resembled an ocean pier more than a bay pier. Winter storms, in particular, were extremely stressful on the entire fleet. In 1980, in anticipation of rebuilding *Wapama* she was placed upon Barge 214. Since that time she has remained on the barge and received limited maintenance. Currently, she resides atop Barge 214 in a flooded graving dock at the Richmond Reserve Shipyard in Richmond, CA.

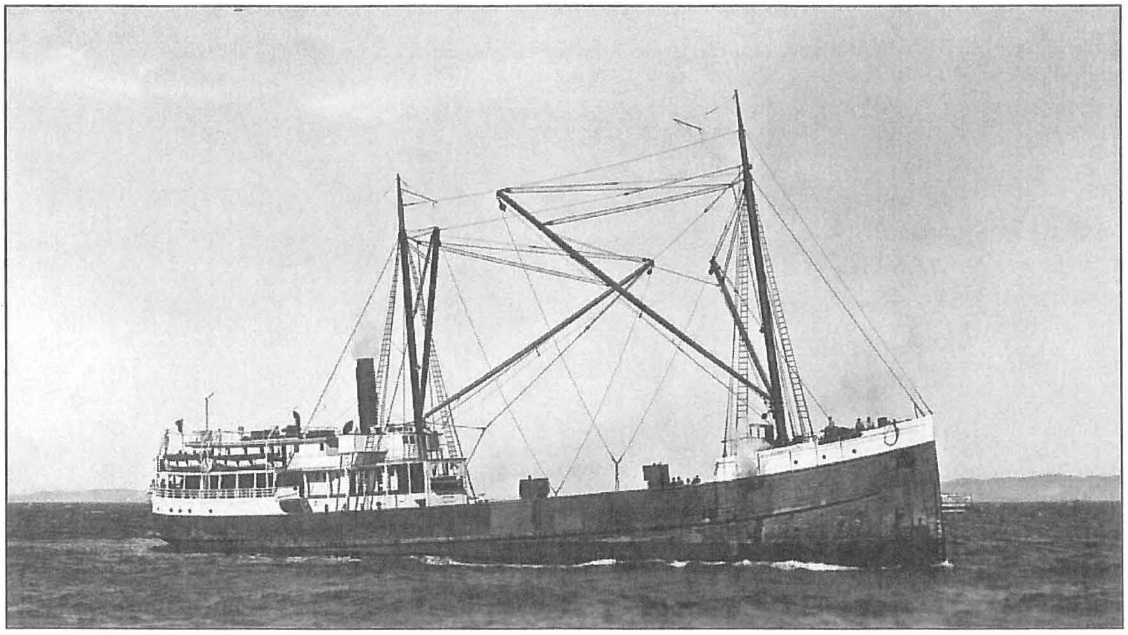

Figure 1 – SS WAPAMA circa 1935

In February 2005 BMT Designers & Planners, Inc. (BMT D&P) was tasked as a subcontractor to Architectural Resources Group (ARG) to undertake a condition survey of the vessel and barge and to provide preservation recommendations. Included in the scope of work for D&P were:

- An updated safety and stability determination of the barge and vessel, both separately and in combination, in her present location.
- An updated structural analysis of the vessel's main features and support structure.

The results of the structural analysis of the vessel and safety and stability review were completed in August 2005 and the results of these analyses are summarized in D&P Report No. 2526-001 entitled "Wapama Condition Survey" (Reference 1). Within Reference 1, the current status of the vessel and Barge 214 was documented and some preliminary preservation and stabilization recommendations were made. A follow up report from the Natural Resources Research Institute (NRRI) at University of Minnesota Duluth and USDA Forest Products Laboratory entitled, "Condition Assessment of Main Structural Members of WAPAMA", (Reference 2) analyzed the current condition of *Wapama*. This report revealed that many of the structural members contributing to longitudinal and transverse strength have severe deterioration at some point in their length. The lack of continuity excludes many from strength calculations.

Upon completion of the initial structural survey and condition assessment survey, an analysis of a range of stabilization and preservation recommendations has been undertaken.

Scope of Work

This report outlines the four main options that have been identified for either stabilizing or preserving the vessel. These include:

1. Full Rehabilitation and Restoration
2. Full Stabilization
3. Partial Salvage
4. Dismantling and Selective Salvage

This report summarizes the scope of each of these options, with a rough order of magnitude estimate of costs and the level of work that each option would require, to support the upcoming Value Analyses that are to be undertaken for the vessel.

In addition to the options identified above, it is recommended that consideration also be given to either constructing an interactive 3D computer virtual model of the ship and/or a large-scale quarter scale-hull model to be exhibited alongside the vessel, or with any of the components that are salvaged for display.

Overview of the Results of the Rapid Structural Survey

During the week of June 20th to the 24th 2005 an initial quick look structural assessment of the SS WAPAMA and Barge 214 was undertaken. During this time the vessel and barge were inspected and analyzed for potential safety and stability weaknesses, and areas of actual or potential structural failure were identified. During this quick look structural assessment the 1986 SS WAPAMA Historic Structure Report and a 1985 condition survey of Barge 214 were used as a baseline for assessing the vessel and barge's condition. As noted above, Reference 1 summarizes the results of that survey, and it is not the intent of this report to recount those results in their entirety. However, a brief overview of some of the main findings of Reference 1 is provided here to give a general overview of the state of the vessel and its moorings at the Pt Richmond facility.

Barge 214

With respect to Barge 214 the quick look structural survey revealed no significant structural problems, although a visual inspection of the tanks indicated the collection of a small amount of water and other fluids in some of the tanks, as shown in Figure 2. It would be necessary to pump these fluids out of the bilges in order to complete the visual inspection. Regular maintenance and some localized repairs were suggested to replace localized bottom damage.

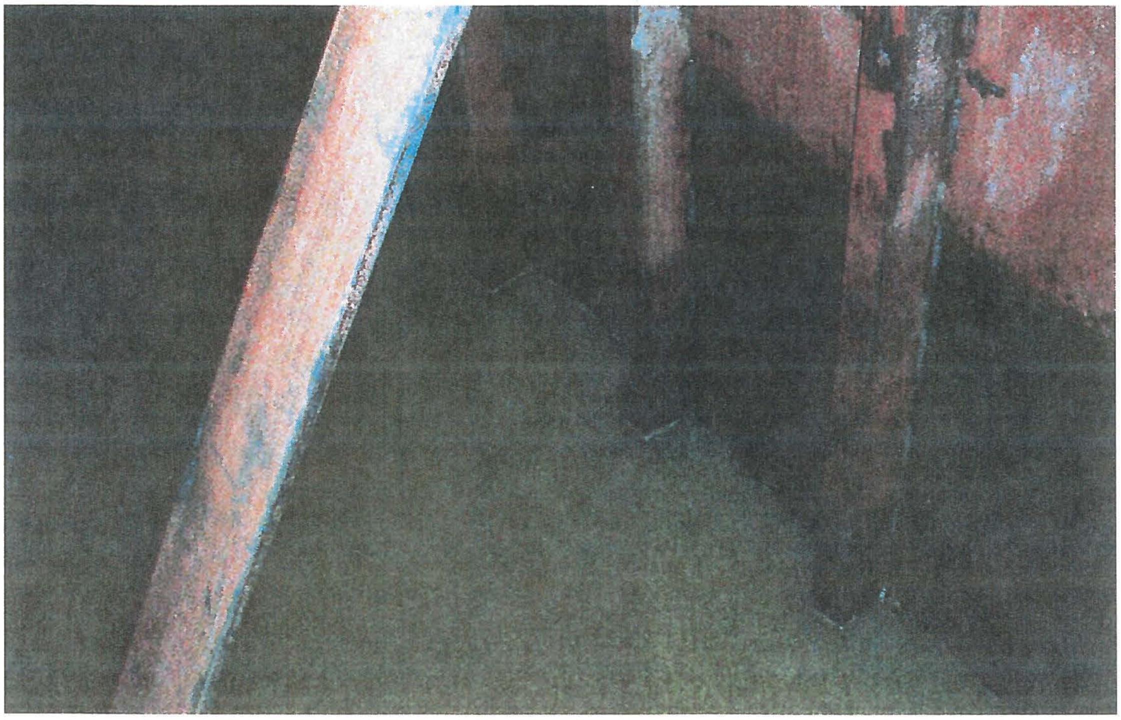

Figure 2 – Example of Fluids in Bilges of Some Tanks on Barge 214

SS WAPAMA

With respect to SS WAPAMA the quick look structural survey revealed that the after superstructure is in relatively good shape, as shown in Figure 3, though there is some deterioration/damage along the Starboard Side Boat Deck, as shown in Figure 4.

Overall, the current state of the main deck house shows little change from the condition described in the 1986 Historic Structure Report (HSR). It was noted that this was due in large part to the efforts of the NPS / SAFR maintenance personnel assigned to *Wapama*. This staff, with the help of volunteers, has kept these spaces ventilated while also protecting them from the environment and rainwater seepage, in keeping with recommendations that were made in the 1986 HSR.

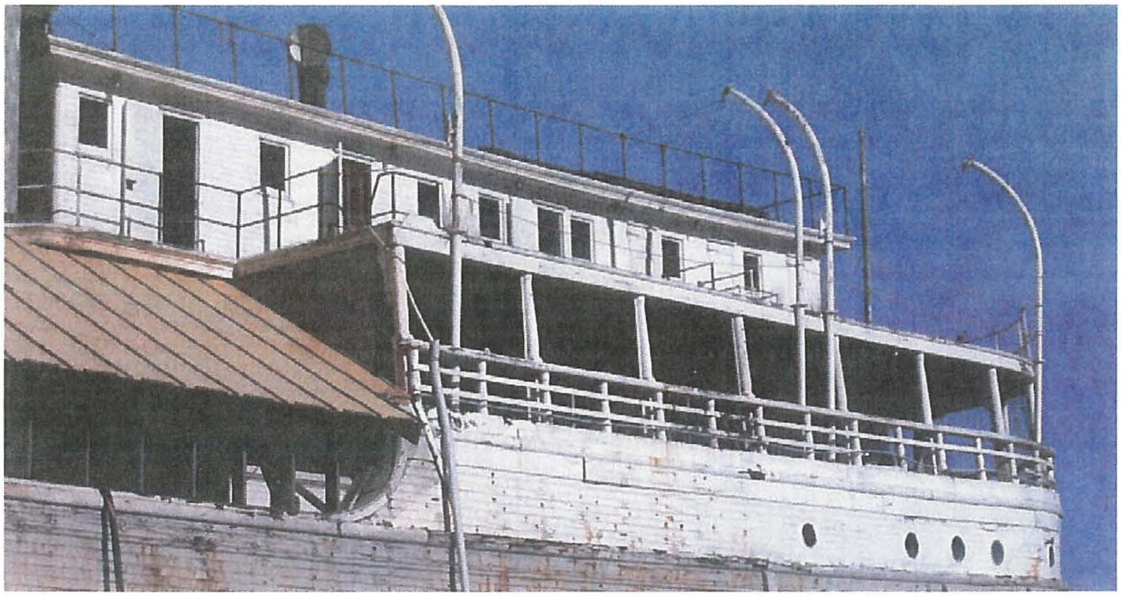

Figure 3 – SS WAPAMA Superstructure

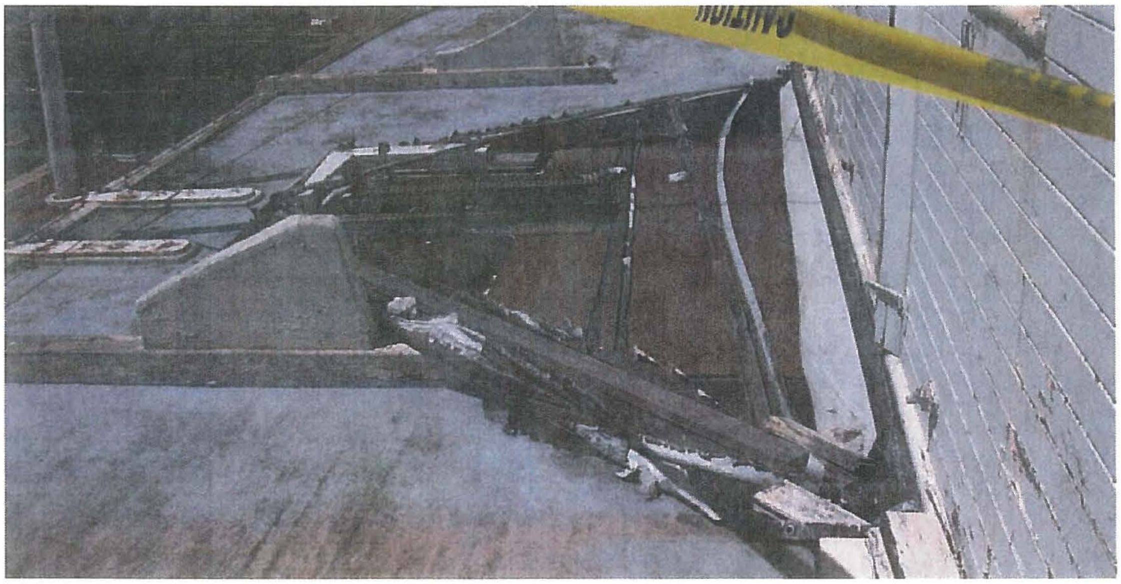

Figure 4 – Deterioration/Damage along Starboard Side Boat Deck

Although the main machinery space shows significant deterioration of some of the auxiliary machinery, metal gratings, and boilers (as shown in Figure 5) many of the main machinery components, such as the main engine and generators, are presently in very good condition thanks to some dedicated preservation efforts undertaken by NPS /SAFR staff and volunteers, as indicated in Figure 6).

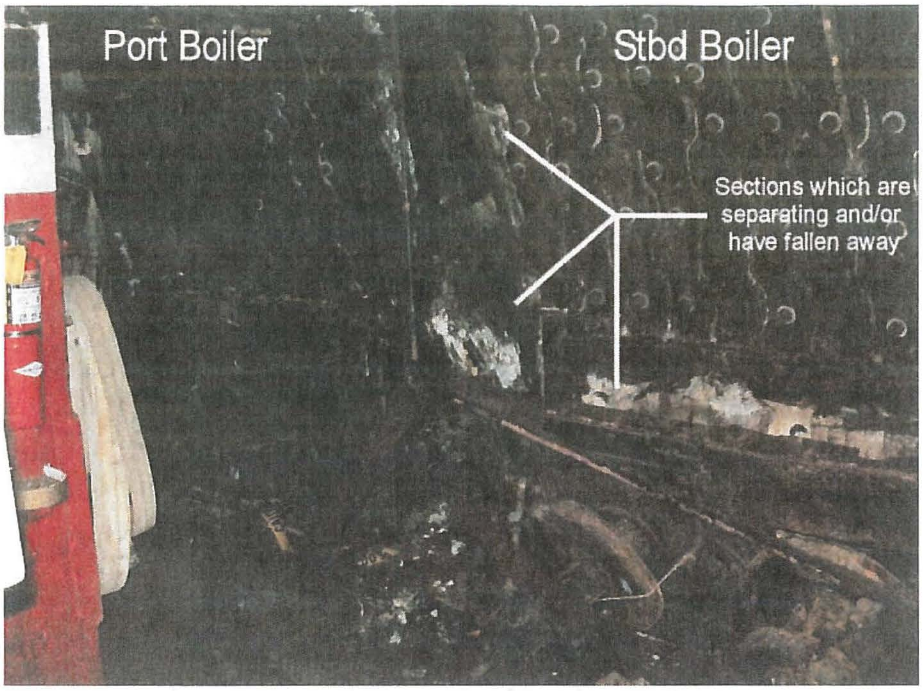

Figure 5 – Current Deteriorated State of Boilers in Engine Room

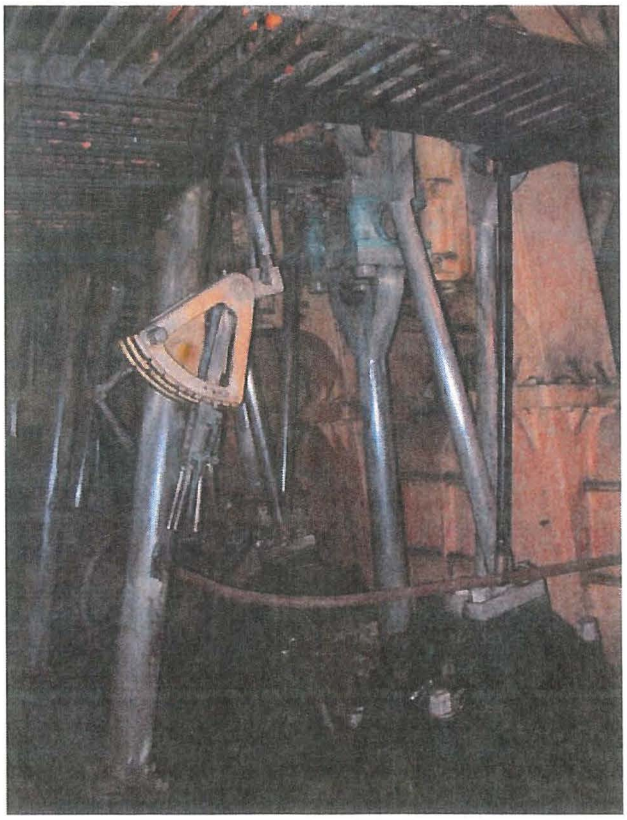

Figure 6 – Main Engine (from below)

The hull and main deck, by comparison, were found to be in an extremely deteriorated state. *The Condition Assessment of Main Structural Members of WAPAMA* addresses the extent of deterioration. The damage to the exterior hull planking and sheathing was found to be disintegrating, as shown in Figures 7, 8, and 9.

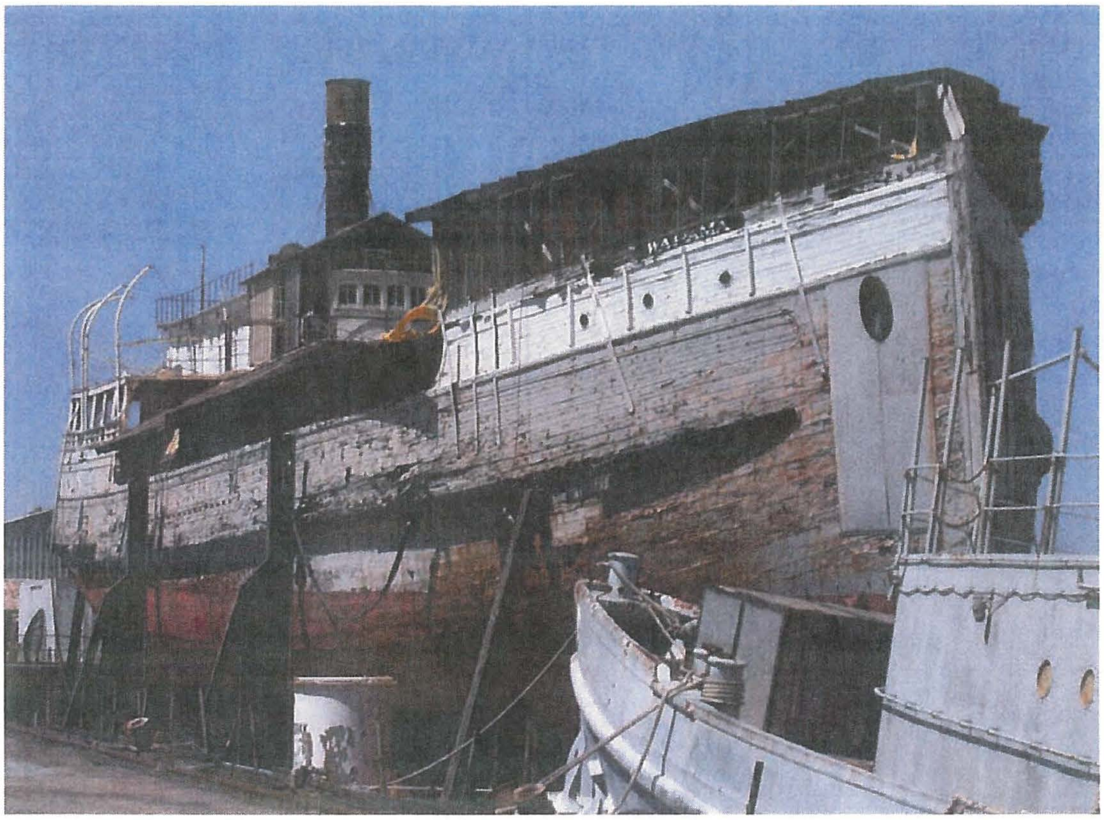

Figure 7 – SS WAPAMA Current Exterior Condition

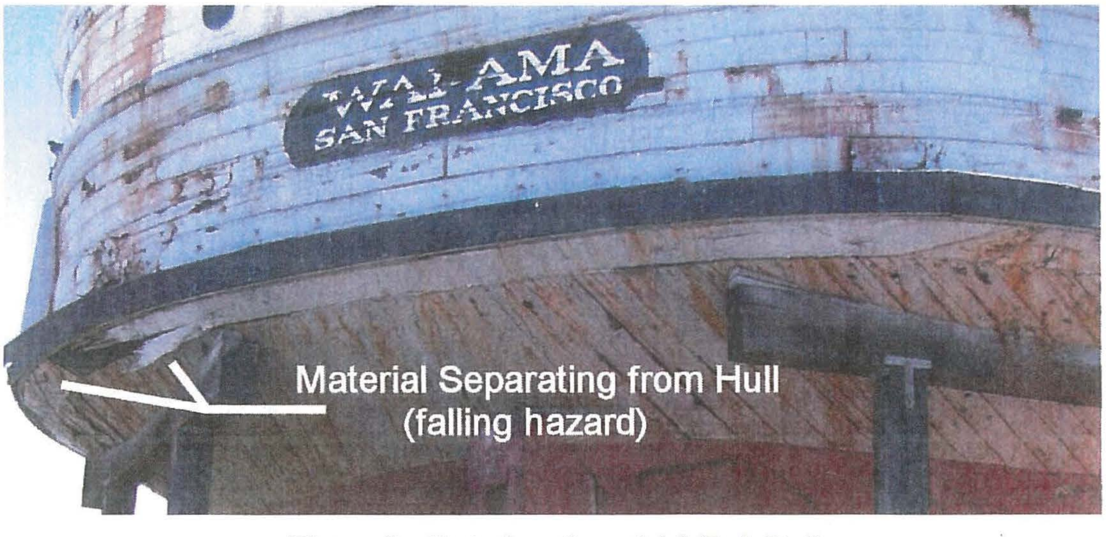

Figure 8 – Deterioration of Aft Rub Rail

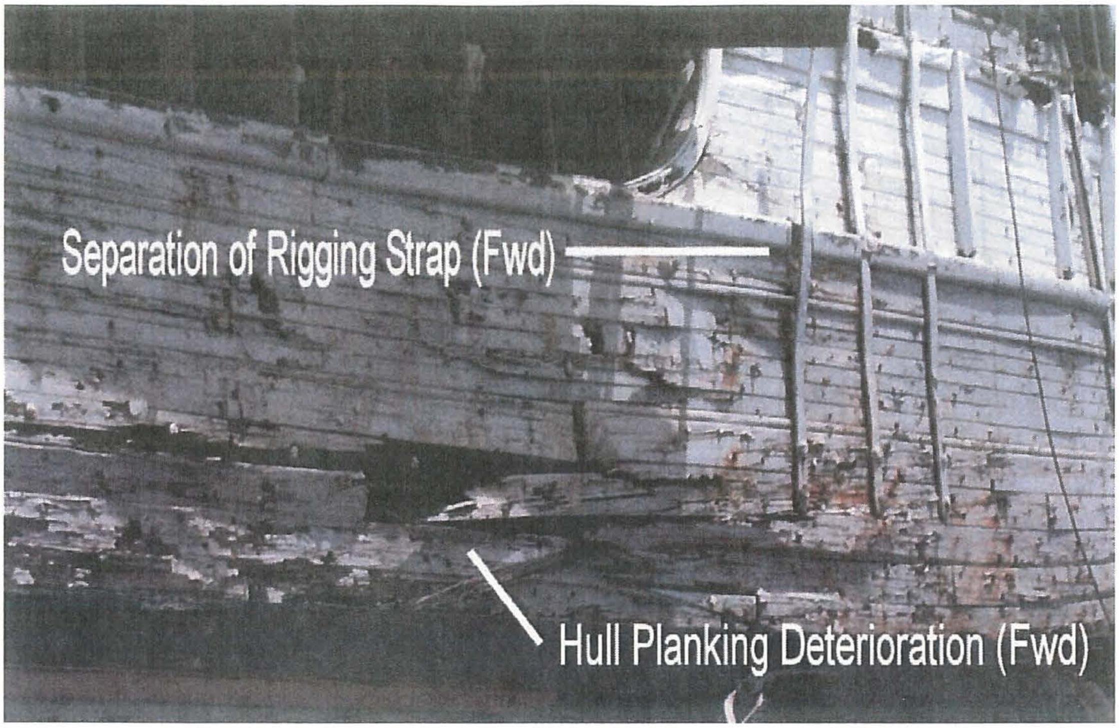
Separation of Rigging Strap (Fwd)
Hull Planking Deterioration (Fwd)

Figure 9 – Deterioration of Hull & Fittings (Fwd)

One area of particular concern from a personnel and vessel/barge safety point of view are the cast iron fairleads on the starboard bow, which could potentially separate from the hull and fall off due to the deteriorated state of the hull and deck planking immediately adjacent to these relatively heavy items, as shown in Figure 10. Due to their weight and size they could also represent a threat to the watertight integrity of the barge if they were to fall from their present locations.

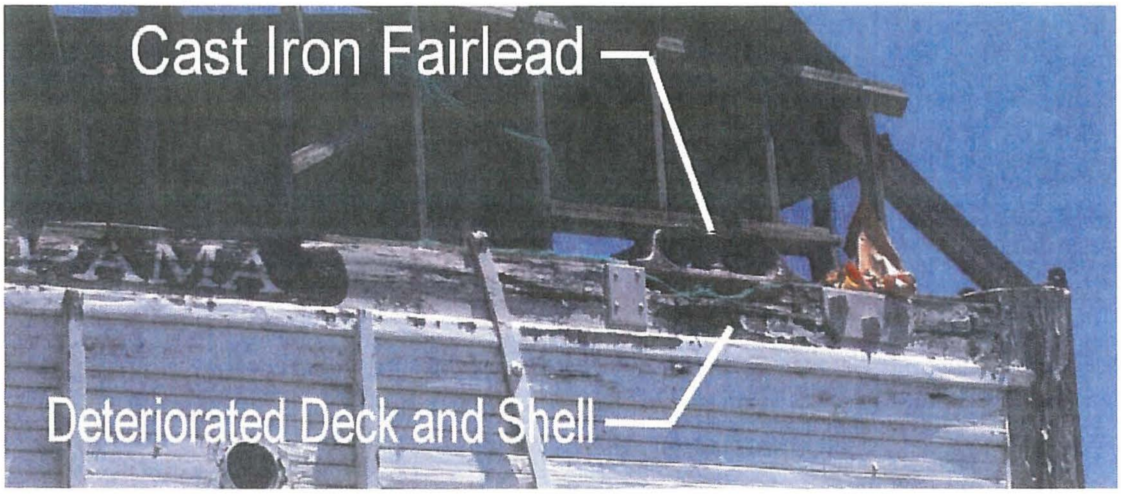

Figure 10 – Deterioration of Deck & Shell adjacent to Cast Iron Deck Fittings

Other potential safety concerns that were identified include the presence of lead based paint along with the possibility of structural collapse. If the decision is made to perform major structural rehabilitation or disassembly of the vessel onsite at the Richmond CA site then consideration will have to be given to how to protect the surrounding environment from contamination from the lead-based paint that has been used onboard the vessel.

Currently, the bow sits askew of the rest of the ship (twisted clockwise to starboard looking from the stern) and is badly damaged, as shown in Figure 11. It has been reported that there is a break in the ships keel, but this would be difficult to confirm without invasive analysis. Additionally, the forward section of bow overhangs the forward edge of Barge 214, and thus is not as well supported as the rest of the ship, as shown in Figure 12, which is of particular concern if the ship is to be towed to another facility. Additionally the deck structure within the focsle is badly deteriorated, as shown in Figure 13. Finally, the vessel also exhibits substantial hog along the length of the keel, as shown in Figure 14. The blocking has likely prevented further hogging of the keel; however, the deteriorated hull can continue to hog around the keel.

Exposure to the elements, specifically fresh water, has caused continued damage to much of the vessel. Within the hold, the aft end of the forward tween deck is currently falling apart, as shown in Figure 15, and the main deck is showing signs of significant deterioration and decay at the forward end of the hatch. Specifically, the main deck stringers exhibit substantial damage and deterioration and the main deck planking exhibits signs of poorly executed repairs from much earlier in her life, as shown in Figures 16 and 17. All these issues contribute to a very perceptible sag in the main deck and main deck stringers surrounding the main hatch opening, as shown in Figure 18. The bulwark planking, frame heads, and deck waterway also all show signs of major deterioration at various locations along the main deck, as shown in Figure 19.

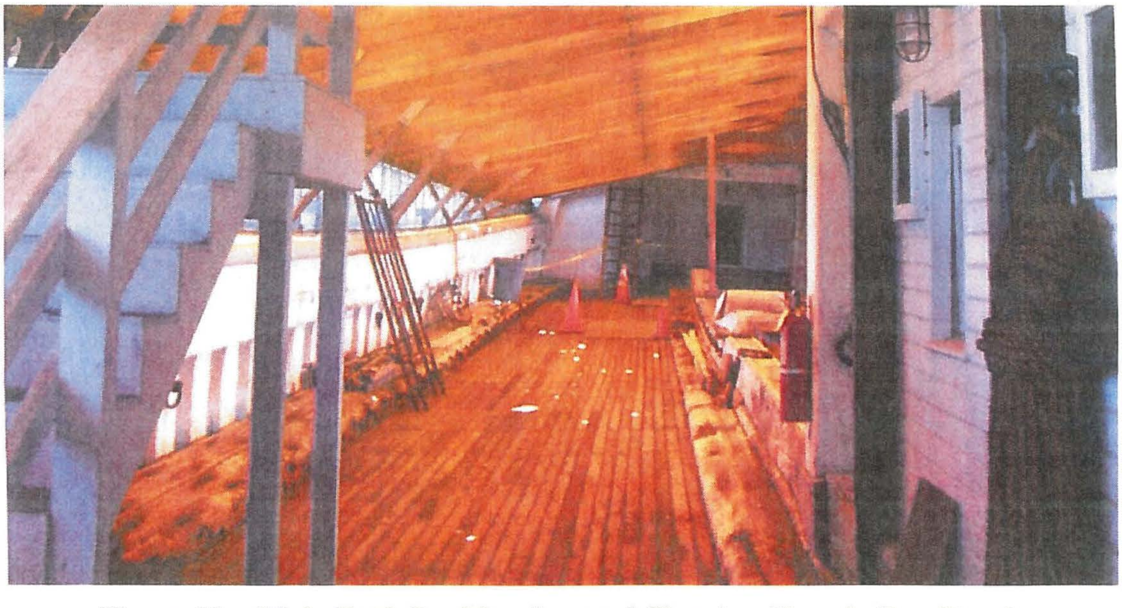

Figure 11 – Main Deck Looking forward Showing Skew in Bow/Focsle

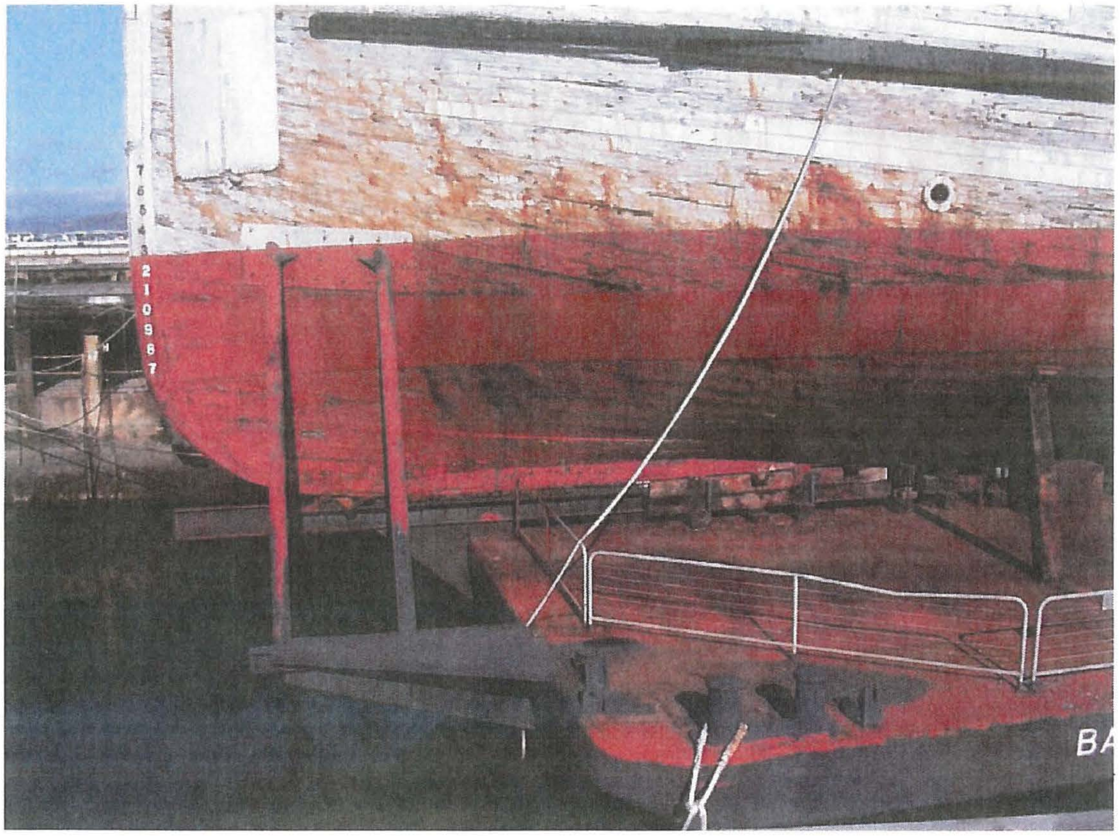

Figure 12 – Bow Overhang with respect to the Barge

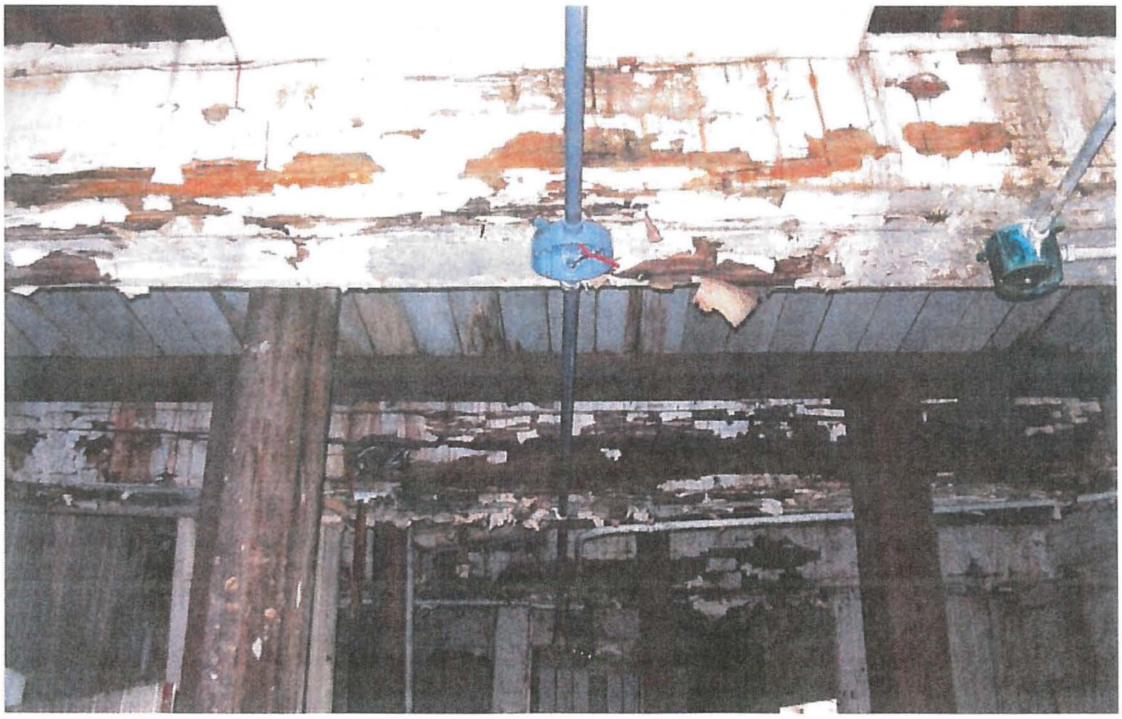

Figure 13 – Deteriorated Deck Structure in Focsle Area

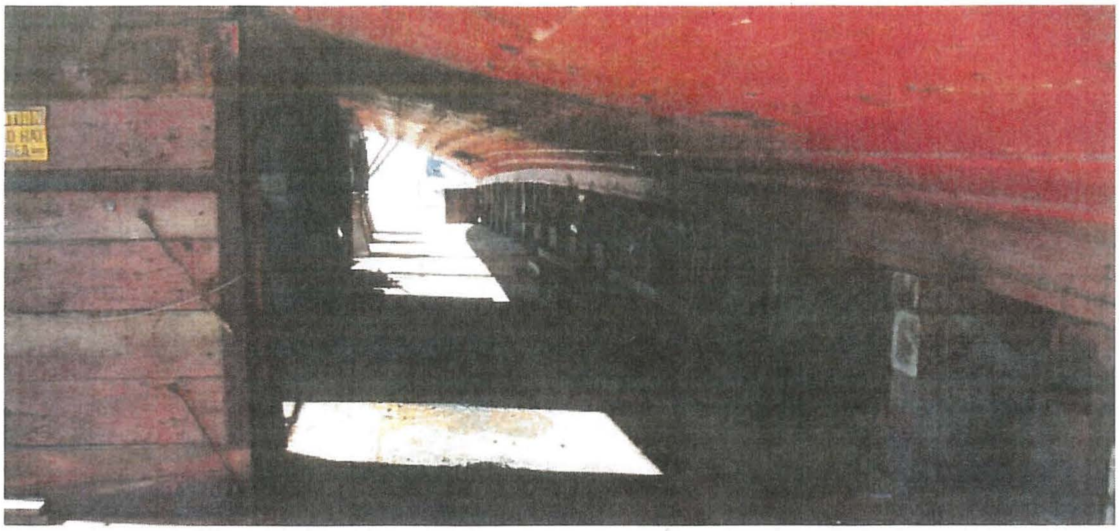

Figure 14 – Keel (looking fwd) Demonstrating Substantial Hog

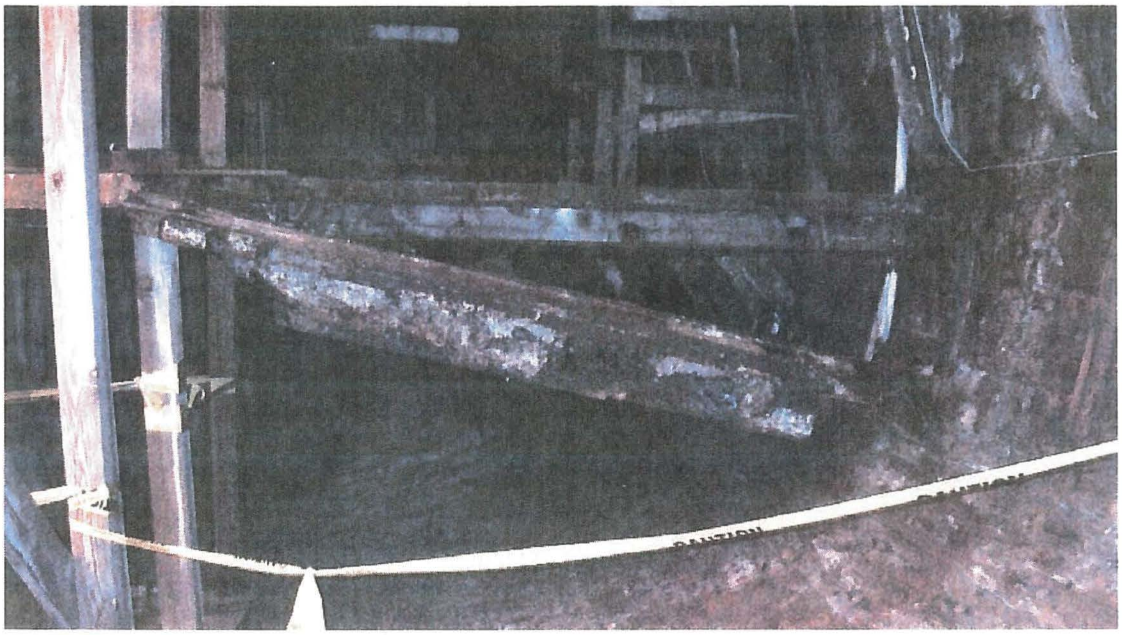

Figure 15 – Collapse of aft end of Forward Tween Deck Supporting Structure within the Main Hold

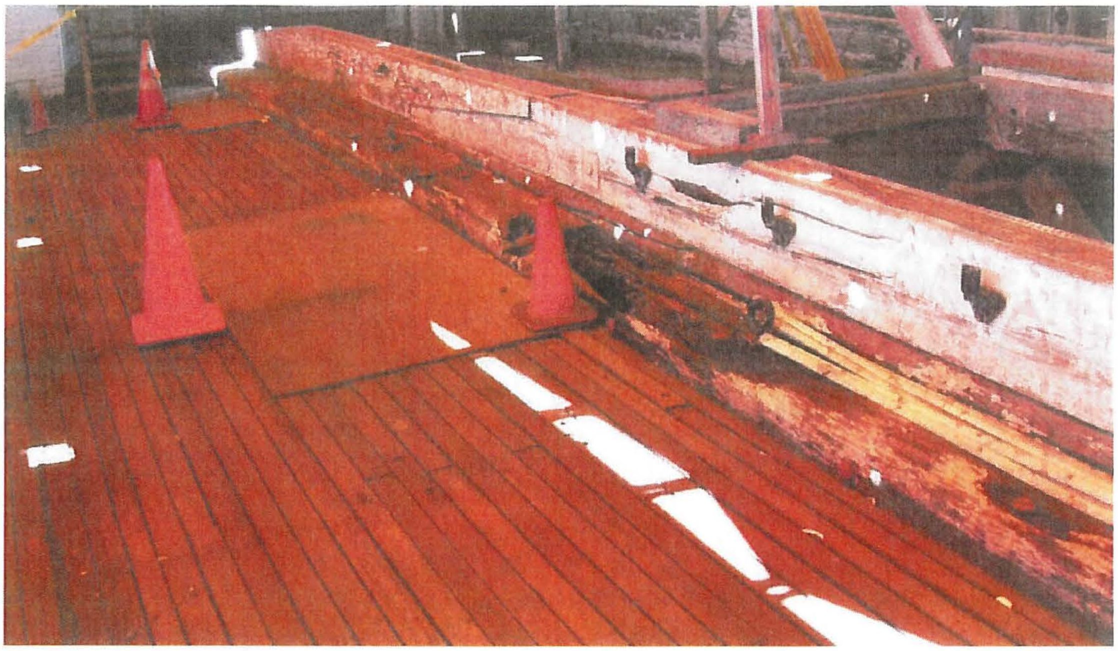

Figure 16 – Deterioration of Main Deck Stringers (Port Side)

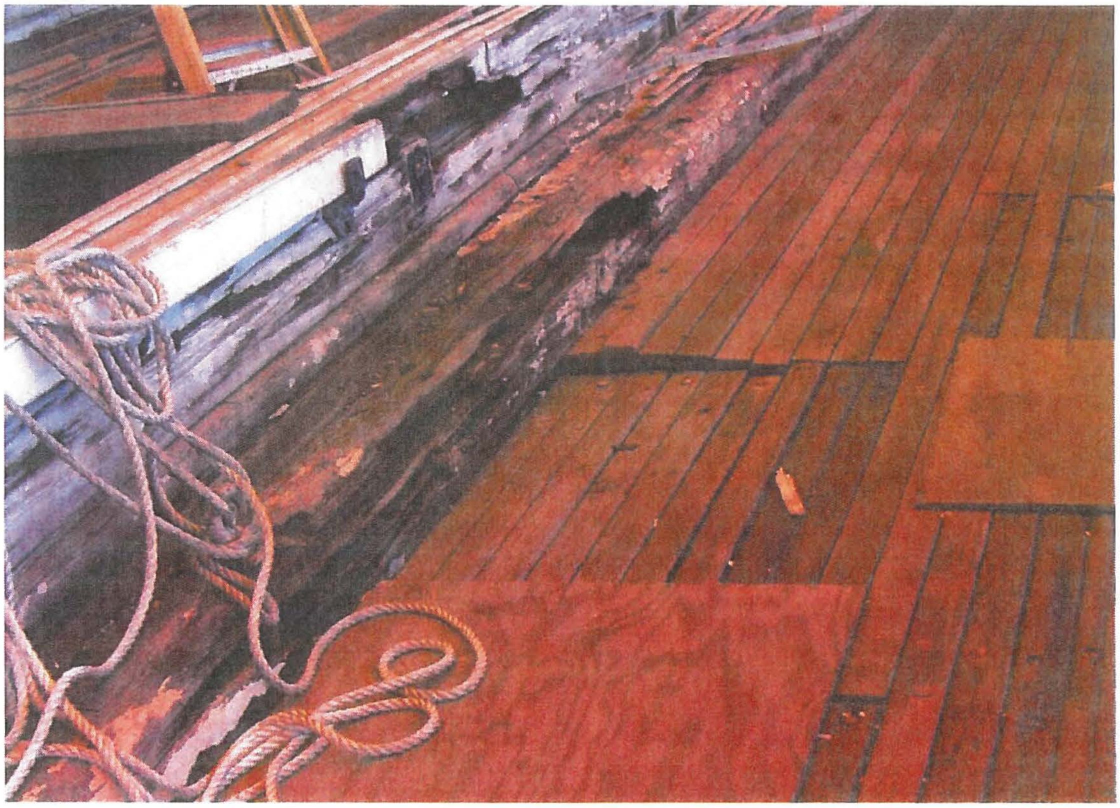

Figure 17 – Deterioration of Main Deck Stringers & Poor Deck Planking Repair (Stbd Side)

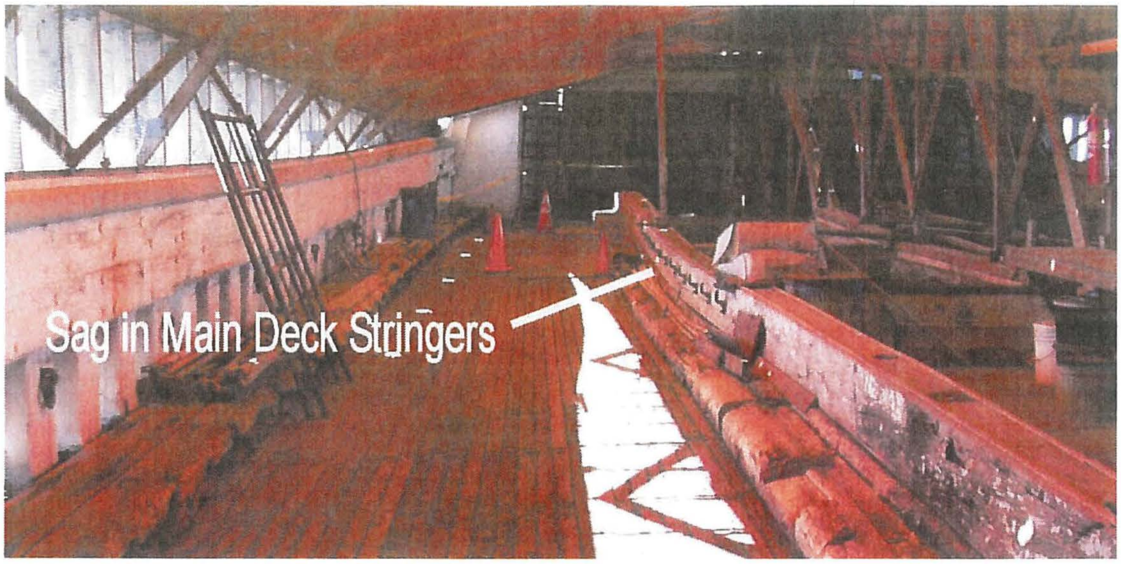

Figure 18 – Sag in Main Deck and Main Deck Stringers at Hatch Opening

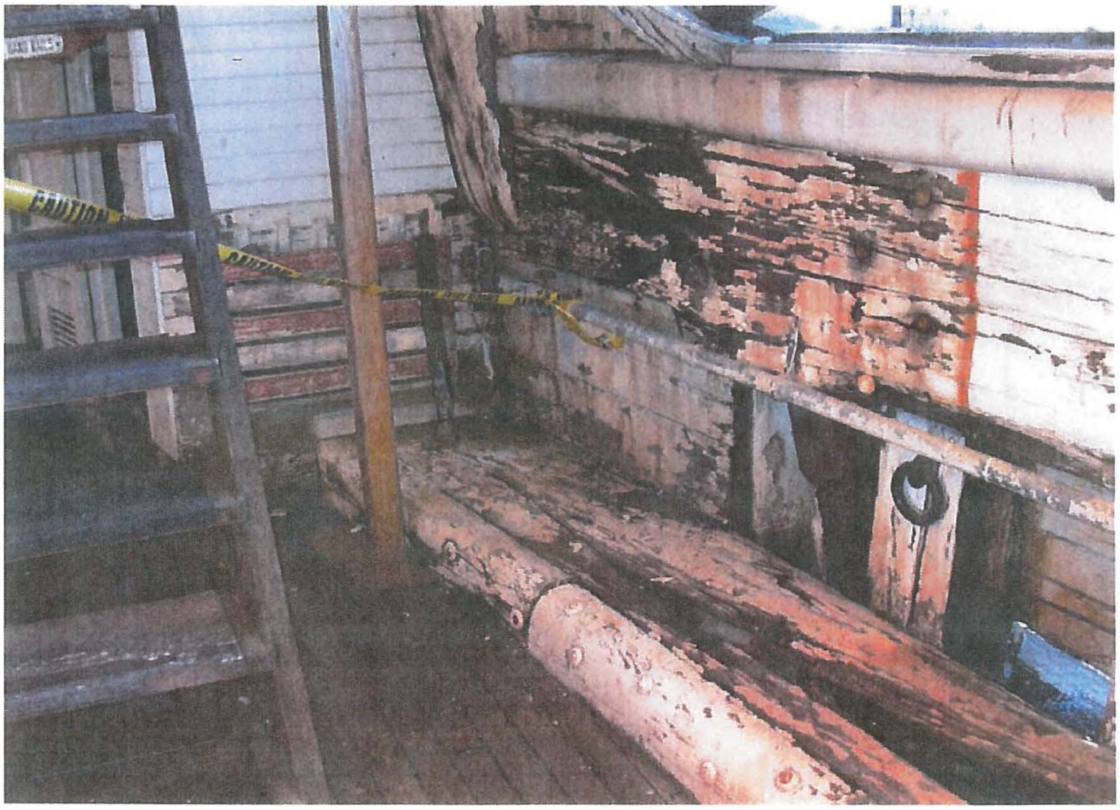

Figure 19 – Deterioration along the Main Deck Bulwark, Frame Heads and Waterway Planking

Preservation and Stabilization Recommendations

Based on the findings of the initial rapid structural survey, four main options have been identified for either stabilizing or preserving the vessel. These include:

1. Full Rehabilitation and Restoration – where the ship is returned to a state suitable for use as a floating exhibit at the Hyde St Pier in San Francisco
2. Full Stabilization – where every effort is made to arrest any further deterioration of the vessel. This could be an ultimate solution, or a stop-gap solution, so that a final decision on the disposition of the vessel can be deferred until some later date.
3. Partial Salvage – where a large section of the vessel and major components of the deck gear and machinery are salvaged for land based display, while the sections of the vessel that are deemed to be too badly deteriorated to be economically restored are disposed of in an environmentally appropriate manner.
4. Dismantling and Selective Salvage – where significant elements of the vessel and a limited number of major components of the deck gear and machinery are salvaged for land based display, while the hull and the balance of the vessel's materials are disposed of in an environmentally appropriate manner.

Because the SS WAPAMA is registered as a National Historic Landmark, full disposal of the vessel is not viewed as an acceptable option. However, due to her current deteriorated state the vessel may soon be a safety hazard and some form of action regarding her disposition is urgently required.

Preliminary ROM Estimates of Potential Alternatives

Option 1 - Full Rehabilitation and Restoration

Based on the size of the SS WAPAMA and experience with the C.A. THAYER restoration work, a ROM cost of ~$35.5M is estimated to accomplish a full restoration of the vessel. This would include limited machinery work, such as refurbishing the main engine and shaft line & bearings to allow the main engine to be "jacked-over" (i.e. a hydraulic motor would be used to rotate the main shaft to demonstrate the movement of the main cylinders, etc). Any attempt to make the plant fully functional would require major refurbishment or replacement of the existing equipment. This would be cost prohibitive as the manufactures of the equipment no longer exist and the machinery would have to be individually manufactured as one of a kind.

It is envisioned that such a full rehabilitation and restoration process would entail;

- Initial documentation
- Addition of additional shoring for move on barge from Point Richmond to Hunter's Point (for example)
- Removal of large deck equipment prior to tow
- Tow by barge to Hunter's Point
- Building use @ Hunter's Point (assume Federal Land/free for rebuild but include any modifications required to building for use)

- Hazmat removals (asbestos/lead paint/oils)
- Disassembly and documentation
- Restoration of machinery, galley equipment and deck gear etc
- Rebuild
- Transport to Hyde St Pier

A breakdown of the ROM cost estimate to accomplish each of these steps is provided in Appendix A. This option could also be accomplished outdoors. This would require substantially higher costs due to protection requirements, weather delays, and adverse working conditions.

Option 2 – Full Stabilization of Vessel

Currently the exterior of the vessel is in an extremely deteriorated state. The vessel's own weight is stressing her primary structure. However, due to her current state it is unclear how effective this structure is and the potential for cascading catastrophic failure exists (where the failure of one part of the structure can lead to more extensive structural collapse). As such work should be done as soon as possible to prevent further deterioration. The potential exists to either attempt to stabilize the current state of the vessel at her current location in Pt Richmond, or to move her to a covered facility, such as the warehouses at Hunter's Point.

If the vessel is to be maintained in her current location then it is suggested that repairs and stabilization efforts up to a ROM of $10M would be in order.

It is estimated that a ROM cost to move the vessel to a covered storage facility, such as the Federal Buildings at Hunter's Point would be in excess of $1.0 Mil. Relocation of the vessel to a covered storage facility would help slow any further deterioration of the exterior of the ship, however, in her current state the exterior of the vessel is so far decomposed that there would be very little of it that could be salvaged during a future restoration and rehabilitation. As with the other stabilization option discussed above, repairs and stabilization efforts up to a ROM of $12M would also be in order.

It is envisioned that if this work were to be undertaken in place at the Point Richmond facility then such a stabilization effort would entail;

- Initial documentation
- Add additional shoring as required
- Removal of large deck equipment
- Building Use @ Hunter's Point (assume Federal Land/free for rebuild but include any modifications required to building for use)
- Undertake Major Borate and Other Treatment to Preserve Remaining Wood Structure
- Hazmat removals (asbestos/lead paint/oils)
- Prepare Iron Machinery and Gear with "Cosmoline" to Help Preserve
- Build structure over graving dock to protect vessel
- Lay Up @ Pt Richmond

It is envisioned that if this work were to be undertaken at a facility such as Hunter's Pt then such a stabilization effort would entail;

- Initial documentation
- Add additional shoring for move from Pt Richmond to Hunter's Pt
- Removal of large deck equipment prior to tow
- Tow by barge to Hunter's Pt
- Building Use @ Hunter's Pt (assume Federal Land/free for rebuild but include any modifications required to building for use)
- Undertake major Borate and other treatment to preserve remaining wood structure
- Hazmat removals (asbestos/lead paint/oils)
- Prepare iron machinery and gear with "Cosmoline" to help preserve
- Lay Up @ Hunter's Pt

A break down of the ROM cost estimate to accomplish each of these steps is also provided in Appendix A.

This option would help to arrest the decay and preserve the most historic fabric. It must be noted that such an effort would do little more than maintain the vessel in its current state.

Option 3 – Partial Salvage, Restoration & Display of a Major Portion of the Vessel and major components of the deck gear at a Land Based Facility

Due to the extremely deteriorated state of the forward section of the ship, as discussed above and documented in Reference 1 the forward end of the vessel is considered to be beyond reasonable economic salvage. However, the after section of the vessel, including the deckhouse and main machinery appear to be in relatively good condition. As such, consideration should be given to retaining the after section of the vessel as part of a land based display, along with major components of the deck gear.

It is recommended that the vessel forward of frame 45 be disassembled and disposed of in place at the Point Richmond facility, with the remainder of the ship transported by barge to a land based facility, such as Hunter's Point for rehabilitation and eventual display.

It is envisioned that such a partial salvage effort would entail:

- Initial documentation
- Assume in site deconstruction of hull back to FR 45 (or as defined by NPS)
- Remove large, intact pieces from forward portion of the ship to be included in future display
- Demolition of remaining components of vessel
- Disposal of remaining components of vessel
- Add additional shoring and weights to balance load for move from Point Richmond to Hunter's Point
- Tow by barge to Hunter's Point
- Building Use @ Hunter's Point (assume Federal Land/free for rebuild but include any mods required to building for use)
- Undertake major Borate and other treatment to preserve remaining wood structure
- Hazmat removals (asbestos/lead paint/oils)
- Hull Repairs for viewing (view in cross section)

- Mock up skeleton of main hatch and bow section to impart overall vessel size
- Internal repairs to aft section for visitor viewing
- Install lighting and develop interpretive exhibits
- Construct means of access for visitors to get onboard

If a partial salvage and restoration of the vessel along these lines were undertaken the ROM costs would be on the order of $12M.

A break down of the ROM cost estimate to accomplish each of these steps is also provided in Appendix A.

Figure 20 shows the nominal minimal amount of space that would be required for such a display. Here the upper sections of aft mast & engine exhaust stack would have to be removed but could be displayed nearby. The required minimum internal dimension of display building would be ~ 113 ft length with a height of ~ 51 ft. In such an arrangement the forward end of the section of the vessel on display would be open to allow visitors to see a cross section of the vessel's hull structure. Additionally, markers could be set up to show the relative location of the bow and forward hold to give visitors a sense of the overall size of the vessel. If these markers are to be contained inside the building, artifacts from the vessel could be displayed in their appropriate relative position. This larger building would need a floor plan of 300 ft by 150 ft to be meaningful. This would provide 50 ft off each end, and to each side.

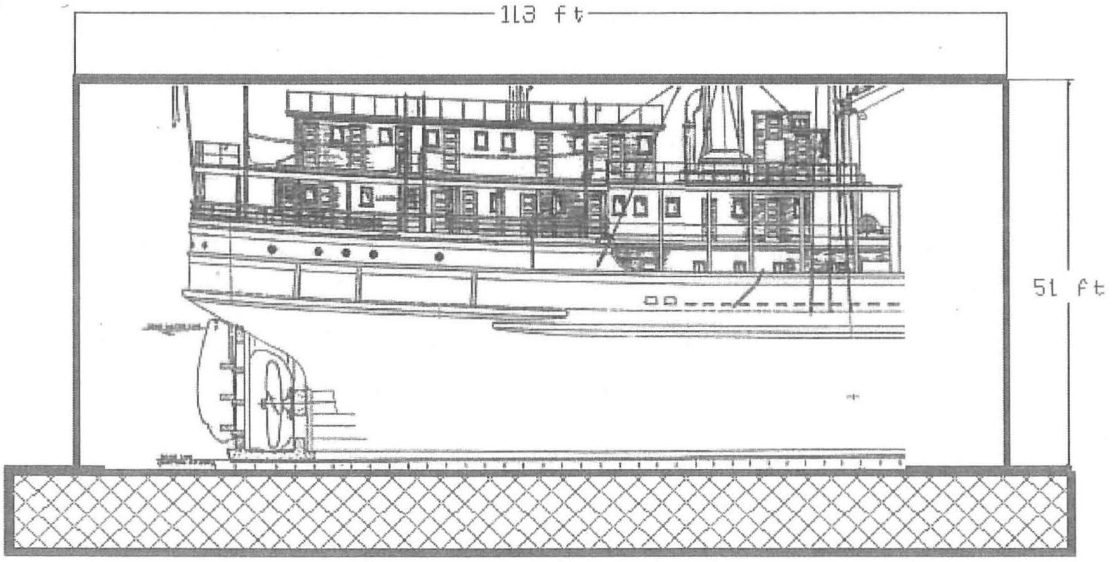

Figure 20 – Display of nearly complete aft section of vessel in a Covered Facility

Figure 21 shows a nominal minimal amount of space that would be required to display the main deckhouse. Here the engine exhaust stack could remain in place however upper sections of masts would have to be removed but could be displayed nearby. The required minimum internal dimension of display building would be ~ 113 ft length with a height of ~ 47 ft. The machinery plant could also be displayed alongside or in a pit dug below ground level.

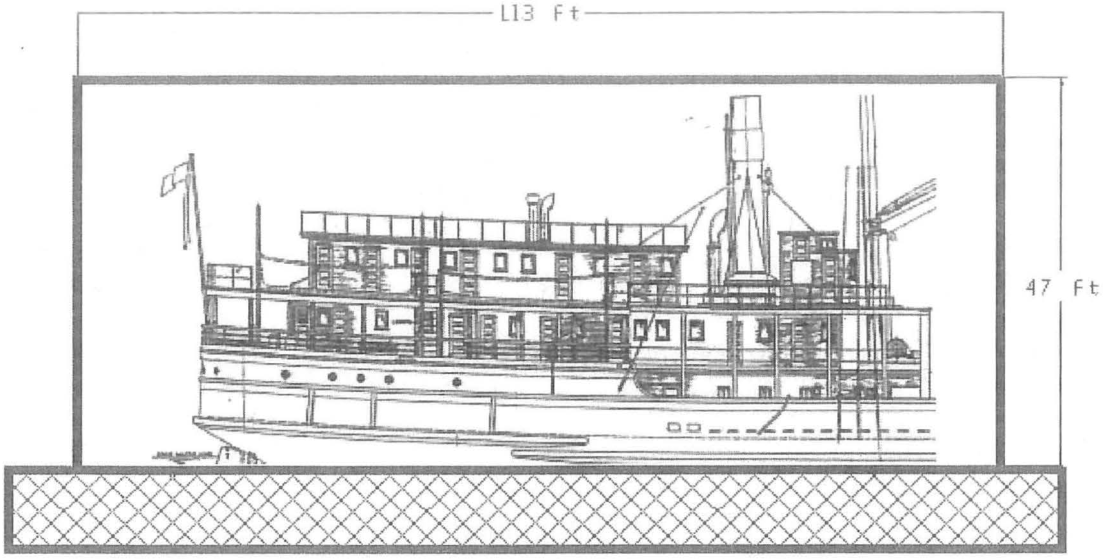

Figure 21 – Display of aft section of vessel above load waterline in a Covered Facility

Such a display could also be set up in conjunction with an interactive 3D computer virtual model and/or a 1/4 scale model of the vessel constructed to also assist in demonstrating the overall size and layout of the complete vessel as she was originally built.

Option 4 – Dismantling and Selective Salvage, Restoration & Display of Elements of the Vessel and major components of the deck gear at a Land Based Facility

Due to the overall deteriorated state of the hull of the ship, it is assumed that most of the hull is beyond economical salvage. Only major intact pieces could be removed for display. However, elements of the vessel, including some structural members such as knees, parts of the deckhouse and some of the main machinery still appear to be in relatively good condition. As such, consideration should be given to salvaging elements of the after section of the vessel as part of a land based display, along with some components of the deck gear and machinery, as funding permits.

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It is recommended that the salvaged items be removed and transported to a land based facility, such as Hunter's Point or the National Maritime Historic Park for rehabilitation and eventual display. This option would allow for a much smaller facility to house the artifacts, but would come at the expense of any larger scale interpretation. The remainder of the vessel would be disassembled and disposed of. A ROM cost for this work is anticipated to be $8.1M.

It is envisioned that such a selective salvage effort would entail;

- Initial documentation
- Determine what is reasonably salvageable for museum display (such as engine, winches, main cabin etc), including large representative structural members

- Salvage of pieces identified above
- Transport of pieces to Federal facility
- Storage or rehabilitation of salvaged pieces
- Hazmat removals (asbestos/lead paint/oils)
- Demolition of remaining components of vessel
- Disposal of remaining components of vessel
- New 10,000 sf museum building

A break down of the ROM cost estimate to accomplish each of these steps is also provided in Appendix A.

Appendix B of this report summarizes a listing of which artifacts would be a priority for salvage on the vessel.

. Additionally, as for Option 3 above, markers could be set up to show the relative location of the bow and forward hold to give visitors a sense of the overall size of the vessel. Such a display could also be set up in conjunction with an interactive 3Dcomputer virtual model and/or a 1/4 scale half-hull model of the vessel to also assist in demonstrating the overall size and layout of the complete vessel as she was originally built. A ROM cost estimate for a ¼ scale model of the vessel is approximately $3.8M based on cost estimates for full-scale wooden ships in that size range.

Recommendations

Based on the data discussed above;

- Significant efforts will have to be accomplished temporarily to prevent further deterioration and possible total loss of the *Wapama*. Her current condition puts her in a dangerous position for an unexpected catastrophic failure. While there are serious implications to partial or total dismantling of a NHL, these must be balanced with the safety of the vessel and personnel who interact with her.
- The total costs associated with the full rehabilitation and restoration option, in combination with the current badly deteriorated state of the vessel would make fully restoring the vessel to a floating display a prohibitively costly and high-risk undertaking.
- The existing highly deteriorated condition of the vessel also suggests that an attempt to stabilize the vessel for possible restoration at a later date would be a costly and risky undertaking involving substantial shoring. It would do little more than maintain the vessel in its current state and minimize further deterioration. which may not show an appreciable return to the NPS for such a large investment of funds.
- A partial salvage and restoration of the aft section of the vessel would allow the NPS to retain and display some of the more interesting sections and components of the ship as well as displaying a cross section of the major structure, which could be of educational interest to visitors to the park.
- Selective salvage and restoration of elements of the vessel would allow the NPS to retain and display some of the more interesting sections and components of the ship at a lower total cost than salvaging & restoring major portions of the hull.

> This option would have the extreme adverse effect of losing the historic resource as an entity and would be the last resort option.

Though the full stabilization of the vessel with possibility of future restoration is a possibility and would preserve the historic fabric, it is recommended that either a partial or selective salvage and restoration would be the most economically feasible solution, depending on the total amount of funds which may be available. Full stabilization would probably not result in a meaningful interpretive exhibit given the amount of temporary shoring and treatment systems involved while the salvage and restoration options would result in interpretive exhibits. As noted above though, due to her current deteriorated state the vessel may soon be a safety hazard and some form of action regarding her disposition is urgently required. Therefore, partial dismantling i.e., documentation and removal/storage of some or all of the heavier components, such as the machinery, would be a positive measure and a step toward reduction of the (known) safety hazards; most if not all of these items would require removal from the vessel regardless of the Option that is ultimately chosen by the Park Service.

One final area of concern that should be noted with regards to any attempt at full or partial rehabilitation and restoration of the vessel, or any portion of the vessel, is the level of uncertainty in the state of the structure that is currently not readily accessible. The initial study that was prepared by BMT indicated certain areas that were obviously decayed beyond the point of repair. There were also areas that, although they appear to be stable, are isolated or not "connected"; in other words there is not sufficient continuity within the structure to continue to support itself in the ongoing decaying process. The U.S.D.A. Report was completed using more sophisticated scientific methods, providing more detailed data, indicating the condition of areas that are not visible without partial dismantling of WAPAMA's structure; this Report confirmed (reinforced) our initial conclusion that the vessel as a whole is unstable and in defined areas, very unsafe. Based on previous experience with vessels such as C.A. THAYER, the condition of the frames and structure between the inner hull and outer shell planking can vary significantly. As such it is hard to fully anticipate the full extent of work that may be required, or any potential contingencies that may arise during the rehabilitation, stabilization, or salvage efforts.

Thus, there is a certain amount of risk associated with any of the above proposals, with the full rehabilitation having the highest potential risks and the selective salvage potentially the lowest risk due to the reduced scope of items intended for salvage.

Appendix A

ROM Cost Estimates For the Different Restoration and/or Stabilization Options

Option 1 - Full Rehabilitation and Return of Vessel to a Floating Display		
1	Initial documentation	$ 165,000
2	Add additional shoring for move from Pt Richmond to Hunter's Pt	$ 450,000
3	Removal of existing temporary cover	$ 30,000
4	Tow by barge to Hunter's Pt	$ 330,000
5	Building use @ Hunter's Pt (assume Federal Land/free for rebuild but include any mods required to building for use)	$ 2,700,000
6	Hazmat removals (asbestos/lead paint/oils)	$ 1,400,000
7	Disassembly and documentation	$ 3,700,000
8	Restoration of machinery, galley equipment and deck gear etc	$ 3,200,000
9	Rebuild	$ 23,000,000
10	Transport to Hyde St Pier	$ 430,000
	Total	$ 35,405,000

Notes:

1) Initial Documentation estimate includes digital survey of hull as-is
2) Addition of shoring estimate includes both internal and external shoring as required for transport of vessel by barge to the Hunter's Pt facility
3) Removal of the existing temporary cover prior to tow. Removal of large deck equipment is included in a current emergency request
4) Towing estimate includes cost of relocating the two existing vessels berthed aft of the WAPAMA at the Pt Richmond facility
5) The Building use estimate is a current ROM estimate, subject to revision upon a more comprehensive survey of the building. It covers modifications to an existing building
6) The Disassembly and documentation estimate includes the cost of moving the vessel off the barge to the storage building
7) The Rebuild estimate does not include full restoration of the steam plant. A ROM estimate to return the plant to service would be at least $800,000, though due to the extremely deteriorated state of the boilers this could increase pending a more detailed survey of the systems
8) The transport to the Hyde St Pier estimate also includes the cost of relaunching the vessel
9) Estimated Costs are based on current cost of labor and material and work performed in the San Francisco Bay area.

Option 2a - Full Stabilization to Maintain the Vessel for Future Restoration @ Hunter's Pt		
1	Initial documentation	$ 165,000
2	Add additional shoring for move from Pt Richmond to Hunter's Pt	$ 450,000
3	Removal of existing temporary cover	$ 30,000
4	Tow by barge to Hunter's Pt	$ 330,000
5	Building Use @ Hunter's Pt (assume Federal Land/free for rebuild but include any mods required to building for use)	$ 5,000,000
6	Undertake major Borate and other treatment to preserve remaining wood structure	$ 2,800,000
7	Hazmat removals (asbestos/lead paint/oils)	$ 800,000
8	Prepare iron machinery and gear with "Cosmoline" to help preserve	$ 350,000
9	Lay Up @ Hunter's Pt	$ 1,600,000
	Total	$ 11,525,000

Notes:

1) Initial Documentation estimate includes digital survey of hull as-is
2) Addition of shoring estimate includes both internal and external shoring as required as required for transport of vessel by barge to the Hunter's Pt facility
3) Removal of the existing temporary cover prior to tow. Removal of large deck equipment is included in a current emergency request
4) Towing estimate includes cost of relocating the two existing vessels berthed aft of the WAPAMA at the Pt Richmond facility
5) The Building use estimate is a current ROM estimate, subject to revision upon a more comprehensive survey of the building. This estimate is higher than the estimated cost for the building for the Full Rehabilitation option, due to the longer time frame in question and to account for any potential added costs required for humidity control etc.
6) The Lay-Up estimate includes the costs for permanent shoring and providing access and utilities
7) Estimated Costs are based on current cost of labor and material and work performed in the San Francisco Bay area.

Option 2b – Full Stabilization to Maintain the Vessel for Future Restoration @ Pt Richmond		
1	Initial documentation	$ 165,000
2	Add additional shoring as required	$ 2,400,000
3	Removal of existing temporary cover	$ 30,000
4	Building Use @ Hunter's Pt	$ 0
5	Undertake Major Borate and Other Treatment to Preserve Remaining Wood Structure	$ 2,800,000
6	Hazmat removals (asbestos/lead paint/oils)	$ 800,000
7	Prepare Iron Machinery and Gear with "Cosmoline" to Help Preserve	$ 350,000
8	Build structure over graving dock to protect vessel	$ 2,000,000
9	Lay Up @ Pt Richmond	$ 650,000
10	Improvements to access and utilities	$ 750,000
	Total	$ 9,945,000

Notes:

1) Initial Documentation estimate includes digital survey of hull as-is
2) Addition of shoring estimate includes both internal and external shoring as required for long term stabilization and storage of vessel
3) Removal of the existing temporary cover prior to tow. Removal of large deck equipment is included in a current emergency request
4) Estimated Costs are based on current cost of labor and material and work performed in the San Francisco Bay area.

Option 3 – Partial Salvage		
1	Initial documentation	$ 165,000
2	Assume in situ deconstruction of hull back to FR 45 (or as defined by NPS)	$ 900,000
3	Demolition of remaining components of vessel	$ 700,000
4	Disposal of remaining components of vessel	$ 600,000
5	Add additional shoring and weights to balance load for move from Pt Richmond to Hunter's Pt	$ 650,000
6	Tow by barge to Hunter's Pt	$ 330,000
7	Building Use @ Hunter's Pt (assume Federal Land/free for rebuild but include any mods required to building for use)	$ 4,000,000
8	Undertake major Borate and other treatment to preserve remaining wood structure	$ 700,000
9	Hazmat removals (asbestos/lead paint/oils)	$ 700,000
10	Hull Repairs for viewing (view in cross section)	$ 2,800,000
11	Mock up skeleton of main hatch and bow section to impart overall vessel size	$ 750,000
12	Internal repairs to aft section for visitor viewing	$ 800,000
13	Install lighting and develop interpretive exhibits	$ 800,000
14	Construct means of access for visitors to get onboard	$ 900,000
	Total	$ 11,780,000

Notes:

1) Initial Documentation estimate includes digital survey of hull as-is
2) Towing estimate includes cost of relocating the two existing vessels berthed aft of the WAPAMA at the Pt Richmond facility
3) The Building use estimate is a current ROM estimate, subject to revision upon a more comprehensive survey of the building and includes costs associated with converting the facility into a facility suitable for display of refurbished artifacts
4) The Lighting and Development of Interpretive Exhibits estimate is a rough estimate and may vary pending further development of plans for display and review of facilities.
5) Estimated Costs are based on current cost of labor and material and work performed in the San Francisco Bay area.

Option 4 – Dismantling and Selective Salvage		
1	Initial documentation	$ 165,000
2	Determine what is reasonably salvageable for museum display (such as engine, winches, main cabin etc)	$ 40,000
3	Salvage of pieces identified above	$ 2,400,000
4	Transport of pieces to Federal facility	$ 550,000
5	Storage or rehabilitation of salvaged pieces	$ 385,000
6	Hazmat removals (asbestos/lead paint/oils)	$ 580,000
7	Demolition of remaining components of vessel	$ 450,000
8	Disposal of remaining components of vessel	$ 600,000
9	New museum building	$ 3,000,000
	Total	$ 8,170,000

Notes:

1) Initial Documentation estimate includes digital survey of hull as-is
2) The estimate for Salvage of specific pieces is a ROM placeholder and may vary pending development of the Owner's final list of items to be salvaged for display.
3) Estimated Costs are based on current cost of labor and material and work performed in the San Francisco Bay area.

Appendix B

Listing Of Priority Artifacts For Salvage On The Vessel

On May 23, 2006 Stephen Canright and Steve Hyman visited the Steam Schooner WAPAMA on Barge 214 at Richmond, California for the express purpose of determining which artifacts would be a priority for salvage related to the dismantling alternative. This alternative, to remove significant artifacts, is a worst case scenario as various and sundry artifacts only maintain their integrity, which sets steam schooners apart from the general cargo trades, when it is possible to show the interrelationships of the various parts and the importance to allowing the vessel's crew to handle all loading, stowage, and unloading of the vessel in port. As separate pieces, preserved and even displayed, it would be difficult to relate the passenger trade to the lumber trade; the immensity of the hold; or the Spartan conditions for the crew and the relative luxury of the passenger saloon.

Much of the deck machinery has already been removed from the vessel such as the forward winch set, the anchor windless, king posts, masts, booms and associated hardware, and is stored in our Alameda Warehouse.

The most important aspects of the vessel (other than its cargo carrying capacity) are the machinery space and the passenger accommodations. Due to the relative good condition of these spaces, it does not appear to be justifiable to break them down into small individual pieces. The most effective preservation of these spaces would be to keep them intact in order to show the interrelationships. Doing this would mean separating the after 100 feet of the vessel; from approximately frame 48 aft, for preservation. Not only is this the most important, but it is the tallest portion of the structure and the heaviest. We recognize that this is option is basically already reflected in another alternative.

These spaces might be divided into smaller portions if the passenger accommodations are separated from the machinery spaces at the main deck level; but one would still be faced with interpretation of the upper engine room space, now without the engine (which presumably would remain with the after portion of the hull). Both sections would still require indoor storage and would occupy a footprint nearly as large as the entire vessel, although not nearly as high. The rudder, stern post, pintles and gudgeons and propeller shaft are significant items that could be removed and preserved separately.

Dismantling of the portion forward of frame 48 would require salvage, protection and storage of typical beams particularly the forward main hatch beam with the official numbers, frames, knees, and a hull section consisting of several frames, keel, keelsons and sister keelsons, garboards, broad strakes and planking, knees, hold pillars and main deck beams with waterways and bulwarks. The ventilator cowls are significant items. Preservation of the bow pointers and breast hooks are important due to their massive size. Fo'c'sle hardware and typical fo'c'sle accommodation including bunks and lockers should also be preserved. (This level of salvage should also be incorporated into alternatives that would not stabilize or restore the forward portion of the vessel.)